

Body Measures	Human Research Program
PI: Sudhakar Rajulu	2013

Body Measures

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<p>Body Measures</p> <p>PI: Sudhakar Rajulu</p>	<p>Human Research Program</p> <p>2013</p>
<p style="text-align: center;">Science Background</p> <ul style="list-style-type: none"> • Suit fit issues in microgravity <ul style="list-style-type: none"> • NASA suit engineers, the EVA Project Office, and the MOD trainers have identified that suit fit in microgravity could become an issue as evidenced during a recent incident on-board the ISS. • It has also been noted that crewmembers often need to adjust their suit sizing once they are in orbit. • This adjustment could be due to microgravity effects on body shape and size (anthropometry) and posture. • Extended hiatus between NBL training and EVA for ISS crewmembers – may decrease familiarity. • An understanding of how the body changes in microgravity is thus necessary to ensure optimal crew performance, fit, and comfort in space. 	

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<p style="text-align: center;">Science Background</p> <ul style="list-style-type: none"> • NASA, currently, does not have sufficient in-flight anthropometric data to assess the impact of physical body shape and size changes on suit sizing and for interior workplace design on future vehicles. • Current information is limited and is based on SkyLab data with few subjects (3). • Recent study on Spinal Elongation (an HRP study in 2009-2011) was primarily focused on Orion seat configuration (microgravity effects on seated height). 	

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<p align="center">Objectives</p> <p>1. To gather and document microgravity effects on body measurements: lengths, breadths, widths, circumferences, and joint angles of subjects exposed to microgravity in an unsuited condition.</p> <p> Expand the data set for suit sizing, workplace design, neutral body posture (NBP), circumference and segmental length measurements to determine how microgravity affects other areas of the body besides the torso.</p> <p>2. To determine if/how the (NBP) is influenced by the above factors.</p> <p>The goal of this study is to gather preliminary data to better understand the magnitude and variability of these changes.</p> <p>This will be the first time these proposed measures are collected in space. It is anticipated that body measurements will change due to microgravity and fluid shifts. This data is important so that the changes that may occur during long-duration space flight can be identified and applied to suit fit, suit sizing, workstation design, etc. for future missions in order to prevent injury and reduce crew time for altering or adjusting suits, workstations, etc.</p>	

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<p style="text-align: center;">Objectives</p> <p>Three activities</p> <ul style="list-style-type: none"> •Activity 1: Anthropometric photographs/measurements <ul style="list-style-type: none"> •Collect digital photographs to measure heights, breadths, depths, lengths •Collect circumferences using tape measure •Collect measurements using anthropometer (ground only) •Activity 2: Neutral Body Posture (NBP) <ul style="list-style-type: none"> •Collect video to determine posture and joint angles (in-flight only) •Activity 3: Weight/SLAMMD Body Mass Measurement <ul style="list-style-type: none"> •Collect weight measurement pre- and post-flight •Collect body mass measurements in-flight 	

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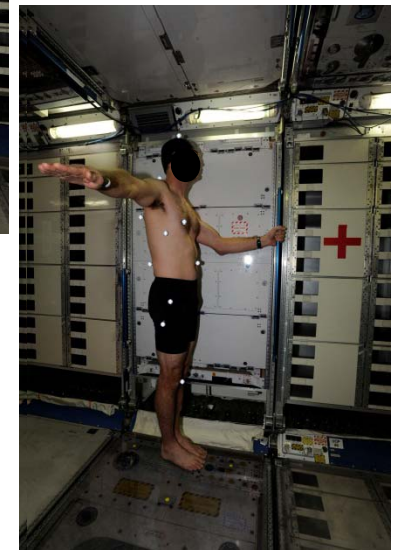
Experiment Design Overview

Preflight	Inflight	Postflight
Body Measures Photographs 1x – L-180	Body Measures Photographs 3x (required) – FD 15, 80, R-30 3x (if time available) – FD 45, 105, 135	Body Measures Photographs 1x – R+30
Anthropometer 1x – L-180	NBP 3x 3x (required) – FD 15, 80, R-30 3x (if time available) – FD 45, 105, 135	Anthropometer 1x – R+30
Weight 1x – L-180	SLAMMD Body Measurements 3x – FD 15, 80, R-30	Weight 1x – R+30

Experiment Description

Pre-flight and Post-flight BDC

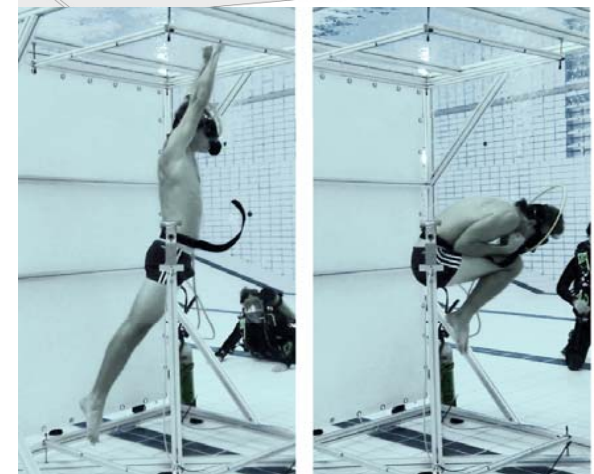
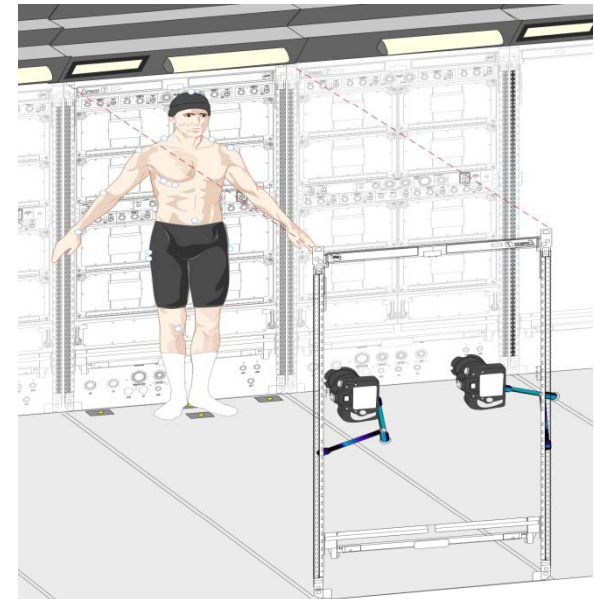
- Collect anthropometric measurements using anthropometer, tape measure, and photographs.
- Performed at the US Lab Trainer
- Change clothes – spandex shorts and top (female)
- Apply body markers to subject and obtain weight
- Collect two photographs per posture for three specific postures in front of rack
 - front facing posture (front)
 - side with right arm extended 45° (side 1)
 - side with right arm abducted 90° (side 2)
- Collect measurements using an anthropometer and tape measure to obtain a standard set of measurements for comparison.
- Discuss NBP activity



Experiment Description

In-Flight

- Collect anthropometric measurements using photographs, tape measure, NBP using video, and SLAMMD body mass measurement
- Collect 2 sets of photographs per posture of subject standing in front of the rack wearing spandex shorts/tops and body markers in three postures
- Collect circumference measurements twice using the provided tape measure, and record in the Data Collection Tool (DCT)
- Collect video of blindfolded subject performing NBP task.
 - Consists of performing 2 phases; an effort phase (stretch/crouch) and relaxed phase
 - Sequence is repeated 10 times per session, altering and randomizing the effort phase posture.
- Collect body mass measurement with SLAMMD



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<p>Experiment Description</p> <p>Measurements to be collected</p> <p>A – Anthropometer P - Photographs T - Tape Measure V - Video</p>	Measurement	Pre-flight	In-flight	Post-flight
	Stature	A, P	P	A, P
	Acromion Height	A, P	P	A, P
	Mid-Shoulder Height	A, P	P	A, P
	Knee Height	A, P	P	A, P
	Hip Height	A, P	P	A, P
	Biacromion Breadth	A, P	P	A, P
	Hip Breadth	A, P	P	A, P
	Chest Breadth	A, P	P	A, P
	Chest Depth	A, P	P	A, P
	Waist Depth	A, P	P	A, P
	Upper Arm Length	A, P	P	A, P
	Lower Arm Length	A, P	P	A, P
	Crotch Height	A, T	T	A, T
	Chest Circumference	T	T	T
	Waist Circumference	T	T	T
	Hip Circumference	T	T	T
	Bicep Circumference, flexed	T	T	T
	Thigh Circumference	T	T	T
	Calf Circumference	T	T	T
	Weight/Mass	Scale	SLAMMD	Scale
	NBP	-	V	-

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<p style="text-align: center;">Benefits of Results</p> <ul style="list-style-type: none"> • ISS is only microgravity environment to determine how long duration space flight will affect the body shape and size. • Results will impact future requirements, suit sizing, work station designs, and vehicle design to ensure crew fit and safety after long duration missions. 	

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Questions?

